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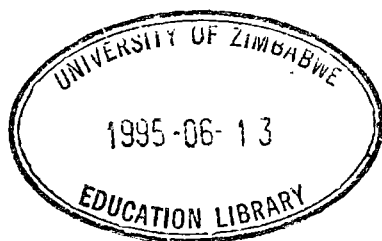# THE ECONOMICS OF EDUCATION: EVALUATION OF THE DETERMINANTS OF PRIMARY SCHOOL PERFORMANCE IN CAMEROON

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INTRODUCTION

Since the resurgence of human capital theory, several studies have revealed that educational investment is profitable both to the individual who undertakes to invest in himself and the society as a whole. These findings and the various recommendations thereof in the human capital Literature have given rise to in-crease in investment in the educational sectors of most countries especially in developing nations (LDCs).

The educational sector of Cameroon has continuously absorbed a substantial proportion of government's budgets since independence. For example, between 1975 and 1985 government budgetary allocations to Education rose from FCFA 8,600 million to about FCFA 50,541 million (1 US$ = 300 FCFA) which is an increase of 588 per cent during the decade. According to UNESCO (1984), government budgetary allocation to education in 1975 represented about 22.7% of current government expenditure while that of 1984 was about 23.2%. Coupled with these high budgetary allocations is the increasing demand for education especially at the primary school level, as evidenced by increased enrollments over the years. For example primary school enrolments rose from

some 967000 pupils in 1972 to a little over 1.6 million pupils in 1985 representing an absolute increase of about 69%. The staff strength on the other hand rose from about 19813 to 32080 within the same period representing an increase of 62%.

In spite of these changes there have been some arguments of late claiming that the quality of primary school eduction in terms of the performance of pupils at the final school examination is on the decline. Although there is no consensus in the human capital literature as to the factors that determine students' performance, there are those who attribute cognitive achievement to school environmental factors while others attribute this to social environmental factors. There are yet others who attribute schools performance to both school environment and other societal factors.

Our main objective in this paper is to examine the main determinants of primary school performance in Cameroon using human capital production concept. This is to fill an existing gap in the lack of a rigorous study in Cameroon to ascertain whether or not the first level of the educational superstructure is efficiently operated. This study should enable us discover the inputs that are very critical in determining students' performance at the primary school level as a prelude to recommending measures to be taken to ameliorate schools' performance given huge government's investments in this sector.

The paper is divided into five sections: The first section takes an overview of human capital production as well as considering some conceptual and specification issues in educational production function. The second section looks at the empirical model to be tested. In section three we present the data and methodology, while section four presents the empirical results. We conclude the paper in section five with some policy recommendations.

LITERATURE

The effectiveness of schools has been of major concern to educationalists, researchers, policy makers and economists, among others, for quite a long time. This concern, especially among economists and researchers, has given rise to tremendous research to measure the relationship between educational inputs and output. Such studies which began modestly in the late fifties and early sixties (Cohn, 1979, pp. 174-176) intensified with the publication of the Coleman Report (Coleman et al., 1966). While some studies have produced overwhelming evidence leading to pessimistic conclusions (Jencks, 1972), others have provided optimistic evidence to warrant the continuous search for the most effective technique in the educational production process (Bowles, 1970; Hanushe, 1979; Umo, 1980).

While there is no general consensus as to the factors that impinge on students' cognitive achievement, evidence in the literature suggests the interaction of varied factors that influence students' performance, some of which include: teachers' characteristics, school environment factors, socio-economic factors (SES) and sometimes chance.

Conceptual and Specification Problems

The Theoretical foundation of an education production function is the neoclassical production function of the firm, with its attendant assumptions which simply describes the maximum output feasible with different sets of inputs. However, the application of industry production to the educational sector is best with a variety of problems peculiar to the educational industry. As Hanushek (1986, p.1142) has rightly noted "typical industry and aggregate production function specifications provide little direct guidance in educational analysis, because they seldom are designed to deal with the detailed policy questions that have been central to investigation of schooling".

Conceptually, educational outputs consist of cognitive and ascriptive aspects while the inputs include students' characteristics, school-related factors and other community influences. While some of these factors can be manipulated by the decision maker, others can not. Apart from this problem and as Cohn (1979) has discussed elaborately, the education production function is entirely unknown; the data set used for its estimation is imperfect and some of the inputs into and some aspect of the ascriptive outputs, are very difficult to measure for lack of data and an appropriate procedure.

At the empirical level most studies in the literature have concentrated on the cognitive achievement of students as the single measure of the educational output while ignoring the ascriptive aspects (of education). The reliance on cognitive achievement, proxies by some achievement test scores or examinations passed, is guided by a presumed relationship existing between achievement and post-school performance in the labour market and other societal characteristics exhibited by the educated vis-a-vis the uneducated. The inherent belief is that schooling makes people more productive in the labour market and better placed to choose and/or appreciate life.

Although the actual relationship between schooling and post-school performance is very hazy, a series of multi-dimensional empirical studies by economists, sociologists and political scientists have confirmed a positive correlation between higher levels of schooling and certain post-school attributes (Mincer, 1974; Pscharopoulos, 1977; Tyler, 1977).

The inability to measure all input into the educational production process has usually led to the application of proxies which may not be perfect representatives of the variables they are meant to represent. It is therefore not surprising that some of the input proxies used in the literature do not seem to exert any statistical influence on the outputs. This according to Cohn (1979, 165) "is not necessarily that the input is ineffective, but,

perhaps, that the evidence does not support the contention that the proxy used is, indeed, a good index of the input".

Despite all these shortcomings and others, discussed elsewhere (see Sato, 1975) in the literature, the estimation of educational production functions can not be completely discarded. Apart from providing a guide for policy (Thurow, 1970, p. 46) it is sometimes necessary to compromise between what is conceptually desirable and the short-coming inherent in the study of educational production functions, since our objective is to evaluate the effectiveness of resource use in the educational production process.

$STAF_t$ = Actual number of teaching staff in a given school at time t.

STR_t = Student/Teacher ratio at time t. This is a proxy for class size.

$ATSL_t$ = Average teacher salary at time t.

$PSEX_t$ = Average expenditure per student at time t

FMT_t = Absolute number of female teachers at time t

$SLOC_t$ = Dummy variable for school location at time t. SLOC = 1 if the school is located in an urban centre or zero otherwise.

Equation 1 states that the number of pupils who successfully graduate from Cameroonian Primary Schools is a linear function of actual number of teaching staff, average class size, average teacher salary, expenditure per student, the absolute number of female teachers on the staff and location of the school. Equation 2 on the other hand is a specification of the same relation in the logarithmic form, not only to derive the partial elasticities of the various variables but also to highlight the more or less joint nature of inputs into the educational production process.

A brief comment on the choice of variables and their expected theoretical behaviour is appropriate. Output (Q) is the success index, representing the absolute number of students who passed the FSLC

THE EMPIRICAL MODEL

Most educational production functions used in the literature are of the form:

$$A_{it} = f(S_{it}, F_{it}, Z_{it})$$

where A_{it} is the achievement test scores of the ith individual student at time t and S_{it}, F_{it} and Z_{it} are respectively vectors of school attributes, family attributes and other attributes for the ith student at time t.

The estimation of the above model hinges very critically on the availability of data on test scores and other attributes in the function. For want of an acceptable test scores for Cameroonian primary schools we adopt macro empirical models for this study. Consequently the production functions for Cameroonian primary schools can be presented by the following models:

(1) $Q_t = a_o + a_1 STAF_t + a_2 STR_t + a_3 ATSL_t + a_4 PSEXt + a_5 FMT_t + a_6 SLOC_t + u_1$

(2) $\log Q_t = \log a_o + a_1 \log STAF_t + a_2 \log STR_t + a_3 \log ATSL_t + a_4 \log PSEX_t + a_5 \log FMT_t + a_6 SLOC + u_2$

where:

$Q_t =$ The number of students who successfully graduate
from a given school by passing the First School
Leaving Certificate (FSLC) Examination.

The difficulty of quantifying the ascriptive aspects of the outcome of education led to the exclusive use of Q.

The use of successful passes at examination as the output measure is a "behavioural manifestation of cognitive changes" in students (Astin in Umo, 1980, p. 27). Such changes determine the future success or failure of students. Furthermore, both government and parents, as well as students evaluate schools on the basis of the number of pupils the school system successfully graduates. Q is therefore accepted to be an adequate, though an incomplete, measure of primary school education in Cameroon in general.

STAF is a very crucial input into any educational system and students' performance is critically dependent on the number of teachers. The absolute number of teachers will determine the extent to which teaching load is reduced or increased. This, in turn, affects the productivity of the teacher and consequently have a bearing on students performance.

It is therefore postulated that school performance is a positive function of staff, in which case we expect the coefficient of STAF to be positive and statistically significant.

STR is used in this study as a proxy for class size as well as a quality index. Like in most studies (Riew, 1966; Umo, 1980; Oguntoye, 1985), the sign of this variable cannot be predicted a priori because of the controversy surrounding its performance. As Umo (1980, p. 28) states "a rise in this ratio will mean $a_2 > 0$ and hence a fall in teacher's efficiency, and a fall in the ratio will imply $a_2 < 0$ indicating a rise in teacher's productivity". The behaviour of the variable is left for empirical test.

ATSL is used as a proxy for teacher's experience and level of education (qualification). It is therefore a quality index (see Hanushek, 1986) and this enables us to hypothesize that ATSL is positively and signifincantly related to school performance. This is based on the assumption that salaries are productivity enhancing. With averagely higher salaries teachers are normally motivated to work harder.

PSEX is used as a quality index (see also Morgenstern, 1973; Umo, 1980). It is hypothesized that PSEX is performance enhancing, in which case we expect its coefficient to be positive and significant. Generally, expenditures to cover institutional basic needs such as libraries, teaching facilities and aids, as well as recreational facilities, will to a large extent, influence students' performance. The intensity of these average student expenditures measures the extent to which school authorities are committed in providing appropriate and adequate study atmosphere for students.

FMT was not chosen on any theoretical grounds but to test a belief in Cameroon that female teachers at the primary school level have contributed to the falling quality of primary schools. This belief stems from the rampant absences among female teachers either due to maternity leaves, child care and other complications usually experienced by women. For this belief to be upheld, it is necessary for the coefficient of FMT to be negative and significant.

SLOC is our proxy for socio-economic (SES) background of students. SLOC enables us to test the hypothesis that urban primary schools perform relatively better than rural schools in which case we expect $a_6 > 0$. The choice of SLOC as a socio-economic proxy was guided by the rural – urban dichotomy prevalent in a developing country such as Cameroon. The underlying assumption is that urban dwellers on the average, have higher incomes, and are relatively more educated to provide the necessary facilities conducive for learning for their children as opposed to the relative low income earners of the rural areas.

DATA AND METHODOLOGY

Cross-sectional data for 1985-86 academic year were used to undertake the study. A random sample of 258 out of 1043 primary schools operating in the North – and South-West Provinces of Cameroon was selected for our purpose. Information on the 258 schools was generated from two principal sources – the Provincial Delegations for National Education and the Education Secretaries of the Baptist, Catholic and Presbyterian Schools.

From the Provincial Delegations, we consulted the relevant officials to exploit questionnaires sent out to primary schools for completion. Each questionnaire contained information on school enrolments, teacher population including their salary grades and qualifications, number of classrooms and class size, among other details. We considered the questionnaires adequate for our purpose in so far as our basic variables in this study were embodied in them. The various Education Secretariats were equally consulted for further information in respect of private schools. This is because the records of the various Education Secretaries are the most authentic and up to date of information on private schools in Cameroon.

It should be noted however that these sources of data generation had their limitations. While noting this limitation this was the most expedient means of generating data for this kind of study.

EMPIRICAL RESULTS

The main tool of analysis in this study was the Ordinary Least Square (OLS) technique. Apart from its expediency, the OLS technique allowed us to apply stepwise multiple regression in which variables were entered in their order of importance (Drapper and Smith, 1966).

The estimations were carried out in three regression equations designated R1 to R3. Equation R1 contains all the six independent variables as specified in the models above. Equation R2 considered only school environment independent variables (STAF, STR and PSEX). Thus ATSL and FMT were not included is this regression to control for possible collienarity problems between them, STAF and PSEX. Finally equation R3 is an attempt to further test the strength of FMT (isolated from STAF) and SLOC in determining school performance.

These results are presented in the table below in the order of their specification, the arithmetic and logarithmic forms respectively.

OLS Estimates of Production Functions for Cameroonian Primary Schools (1985-86) (n = 258)

Independent Variable	Ordinary linear model 1 Dependent Variable (Q)			logarithmic model 2 Dependent Variable (LOG Q)		
	R1	R2	R3	R1	R2	R3
STAF	2.425* (7.60)	2.969* (17.89)		1.008* (8.43)	1.166* (14.40)	
STR	0.058 (1.16)	0.185* (3.36)		-0.537* (-3.25)	?	
ATSL	0.011** (2.20)			1.121* (5.21)		
PSEX	-0.416 (-1.84)	0.030 (0.26)		-1.157* (-5.56)	-0.192** (-2.02)	
FMT	-0.224 (-0.44)		2.633* (7.52)	-0.068 (0.70)		0.482* (6.03)
SLOC	13.671* (5.48)		17.732 (6.39)	0.226* (4.11)		0.266* (4.22)
Constant	-17.269	-10.161	-2.897	-0.923	0.465	0.773

R^2	0.608	0.556	0.490	0.527	0.446	0.364
Std.Error	13.689	14.571	15.622	0.293	0.318	0.340
F-value	69.571	108.351	124.420	48.660	103.850	74.660

Note: ? Variable drop out of regression equation for low tolerance level
t - ratios are in parentheses
* Significant at 1%
** Significant at 5%

An examination of the results row–wise in the above table reveals the following:

(1)The coefficient of STAF is positive and significant which confirms our a priori expectation. The strength of STAF is further confirmed by examining its partial elasticity coefficient in the logarithmic form which is about 1.1 on the average. This implies that a 1% increase in the actual number of teaching staff int the primary schools can bring about at least a 1.1% increase in the number of successful pupils at the FSLC examination in Cameroon. STAF, therefore remains a crucial variable in the educational production process in Cameroonian primary schools. Our finding therefore confirms Bowls' (1970) results and conclusion that "the teacher is the single most important school input".

(2) Class size as proxied by student/teacher raito (STR) shows some instability in sign and level of significance. In the simple linear form (Model 1) STR is positive in all cases but significant when all the variables are used in the equation. In the logarithmic form it is negative and significant among all the variables but drops out of the regression among the school variables.

Although the sign of STR remains ambiguous as was predicted, it could be said that class size is a significant determinant of

primary school performance in Cameroon.   This finding is at
variance with some studies (Cohn, 1968; Riew, 1966) that did
not find any significant relationship between class size and students'
cognitive achievement, but confirms other (Kiesling, in Bowles,
1970, p. 43-44) that did find a highly significant relationship be-
tween STR and cognitive achievement of students.

(3) Average Teacher Salary (ATSL), our proxy for teacher
qualification and/or experience, is consistent with our a priori ex-
pectation and hypothesis that it is productivity enhancing and
hence is positively and significantly related to school performance.
This is evident from the consistent positive and significant coef-
ficient of ATSL in all the equations.   The particular elasticity of
ATSL in all the equations.   The partial elasticity of ATSL is
1.121 as can be seen from the logarithmic function. This shows
that a 1% increase in teachers' salaries on the average could lead
to a 1.1% increase in students' performance in the primary schools.
This result again confirms Cohn's (1968) finding that median
teacher salary is statistically significant and positively related to
school quality as measured by cognitive achievement of students
in varied IQ tests.

(4) Our a priori expectation with respect to per student expen-
diture (PSEX) is rejected.   PSEX, on the whole, is negatively
related to cognitive achievement (except in R2 Model 1).   The
partial elasticity of PSEX is 1.157 as evident from the logarith-
mic function.   This implies that a one per cent increase in per
student expenditure could reduce students' performance by as
much as 1.16% or by at least 0.2% as reported in the second
logarithmic equation.   This result which is similar to Umo's (1980)
finding with respect to per student expenditure in Nigerian univer-
sities would seem to suggest that resources are not effectively
employed to enhance students' performance.   This, by implica-
tion, suggests that a conductive learning atmosphere is not being
provided in such schools, which is in agreement with the general
complaints of inadequate facilities like classrooms, libraries and
other teaching aids, as well as recreational facilities in most primary
schools.

The above interpretation is however tentative since we are not certain of which expenditures may have caused this inefficiency. This stems from the highly aggregative nature of the expenditure items in our data.

(5) The finding with respect to the number of female teachers in a school (FMT) is inconclusive. When considered together with all the other independent variables FMT is negative and weakly related to schools' performance. But when we isolated it from the other variables (R3) it become positive and significant. We cannot therefore draw any unequivocal conclusion considering the behaviour of FMT. More research is called for in this area.

(6) Consistent with our a priori hypothesis, school location (SLOC) which is our proxy variable for socio-economic background (SES) of students is consistently positively and significantly related to schools' performance in all the equations. The strength of this variable can be inferred from its partial elasticities which are 0.226 and 0.266 in Model 2. This finding seems to suggest that school located in urban areas perform relatively well at the FSLC examination. Given that the average income of parents of children in urban schools is higher than in the rural areas, it can be inferred that the children of the relatively well-off parents perform better in school than the children of the relatively poor parents. This finding seems to confirm Coleman's (1966) findings as regards the role of SES in determining the cognitive achievement of students. This implies that we cannot ignore SES in the performance of students in a developing country as Heyneman (1976) and Heyneman and Loxley (1983) have tended to suggest.

This conclusion is however tentative as we can not isolate the causes of the relative better performance of urban schools. This is because we are not certain as to whether this arises from the family background of the pupils in the urban areas or from the school environment itself.

(7) On the overall, our basic primary school educational production function as originally specified (R1) is in accordance with our a priori expectations. The only exception is the variable PSEX which was negatively signed instead of being positive. With the exception of FMT, all of the estimates, especially in the logarithmic form of the model, are significantly different from zero at the 99% confidence level. The relative weak performance of FMT could be attributed to possible collinearity problems between it (MFT) and STAF as the former is a subset of the latter although the stepwise regression shows that the removal of FMT does not significantly alter the results obtained in the basic model (R1).

(8) Considering the overall statistical properties of our model an inspection of the last three rows of the table indicates a relatively good performance of our models. The coefficient of determination adjusted for degrees of freedom (R^2) is encouraging given the parsimony in the choice of input into the educational production process. For example, when all the six inputs are considered (R1), R^2 is 0.608 and 0.527 in the ordinary and logarithmic forms of the respectively. An isolation of the school environment variables in equation R2 yields R^2 of 0.556 and 0.446 in Models 1 and 2 respectively. This indicates that a reasonable proportion of the variation in students' performance in Cameroonian primary schools is accounted for by the variables chosen in the model especially when one realizes that we used cross-sectional data. The test for the overall performance of the model is reasonably high. The F-test shows that all the regression equations are statistically significant at the 99% level.

Summary and Policy Implications

An attempt has been made in this study to specify and test an education production function of the Cameroonian Primary School system in order to identify the variables that impinge on schools performance. The ordinary least squares (OLS) estimates of the functions provide encouraging results. In particular our results revealed that:

- the number of teachers in a school is the most important determinant of schools' performance;

- the average class size proxied by student/teacher ratio is equally an important determinant of students' performance;

- average teacher salary is productivity enhancing as it showed a strong and positive association with schools' performance;

- per student expenditure is very crucial in determining students' performance though there was an indication of an element of waste;

- urban schools seem to perform relatively better vis-a-vis their rural counterparts, and

- the number of female teachers on the staff does not seem to exert any influence on students' cognitive achievement.

The policy recommendations that emerge from our findings, which we hope could ameliorate primary schools' performance in Cameroon are as follows:

(1) Although STAF was used as an unweighted variable, its significant performance indicates that greater attention should be paid to providing adequate teachers. Shortage of teachers especially in rural areas should be stemmed through a pragmatic approach of staff recruitment and on-the-job training. Incentives should also be provided to attract teachers into the rural areas.

(2) The present remuneration structure for the teachers which makes teachers in the private sector (Mission) to earn much less than their counterparts in the public sector should be reconsidered. This will further enhance the performance of such teachers. In addition, rather than give "block sums" as subvention to private schools for teachers' salaries, the government should take over the responsibility of paying private sector teachers directly or take overall primary schools.

(3) Given that per student expenditure suggested some element of waste and, perhaps, insufficient infrastructural provision, we suggest a more careful utilization of the available funds in the primary schools. In addition more funds should be provided to create a conducive teaching and learning atmosphere in the primary schools.

(4) The relative better performance of urban schools over the rural ones suggests some imbalance in the operations of schools. While we subscribe to the view that SES variables could have given rise to this result we also believe that some imbalance is man made. Given that there is acute shortage of teachers in the rural areas while most schools in urban centres are over-staffed, we suggest that a policy of rational allocation of teachers be adopted. In addition the overall development policy of the country should be such that it creates a conducive atmosphere in the rural areas for teachers to operate.

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